

Mount Diablo Astronomical Society

Diablo Moon Watch

March 2012

GENERAL MEETING

Tuesday March 27, 2012

The Hunt for Another Earth

By Geoff Marcy

Doors open at 6:45 p.m.

*Concord Police Association Facility
5060 Avila Road, Concord*



Please come Tuesday March 27 to listen to Geoff Marcy, one of the pioneers in exoplanet detection, having discovered 70 of the first 100 planets.

Geoff Marcy won the Shaw Prize and the Carl Sagan Prize, and was named California Scientist of the Year in 2000. He has appeared on numerous documentaries and on the David Letterman Show. He is a member of the U.S. National Academy of Sciences.

Spaceship Earth

How Humanity will colonize an asteroid after a global catastrophe.

by John A Read

Five or ten years into the future:

Technology hasn't changed much since the year 2012. We have smarter cell phones, but we still get most of our power from burning carbon. A world changing event is about to occur, one that hasn't happened in thousands of years. Last time it happened, it caused a minor ice age, wiping out the woolly mammoth while the human population was still under one million.

Scientists soon realize that earth's magnetic polarity is in the process of reversing. They calculate that whole process will take a few hundred years, relieving the earth of its protective magnetic field. Disaster won't set in right away, we have time to prepare. Magnetic field strength is expect-

Continued on page 10

The Kepler space-borne telescope is hunting for Earth-size planets with hundreds already detected. Kepler has already found definitively rocky planets, like Earth, and is now hunting for habitable ones.

This talk will present up-to-the-minute results from the Kepler Team. Biologists are working with astronomers to assess the environmental conditions necessary for life, especially intelligent life, on planets elsewhere in the universe.



WHAT'S UP

In 1948 Dr Gilbert Bruce Blair asked among local amateur astronomers "why don't we have a meeting once a year to exchange ideas and meet each other" hence Western Amateur Astronomers was born. What role do we, MDAS play in its function and what about its future? In the whats up this month come and hear what Jack Borde, the past president of WAA has to say. *Jack Borde*

PRESIDENT'S CORNER

Observing the Sun in Hydrogen Alpha

by Chris Ford

In my several decades as an amateur astronomer I have spent very little time studying the Sun except for the occasional sun spot solar projection onto white card, or viewing in white light through standard solar filters.

It has become notable that somewhat quietly over the past decade, considerably more sophisticated and affordable solar observing equipment has entered the market and this aspect of observing has become an established sub-branch of amateur astronomy with its own dedicated telescopes, terminology, and challenges. The impending solar maximum has also raised the visibility of solar observing, so when last month I was offered a temporary loan of a Coronado 90mm Solar Max hydrogen alpha telescope I was quite intrigued, and took it home to experiment.

For those unfamiliar with these instruments, a hydrogen alpha solar telescope is a specialized type of refractor designed to enable you to visually examine just one object in the narrow hydrogen alpha wavelength - our Sun, and to do so safely.

Certainly, the notion of looking through a telescope at the Sun is an activity many amateur astronomers are instinctively wary of, even with specialized filters or telescopes that render this activity safe. Personally, at an instinctive level, to actually put my (valuable) eyes up to an eyepiece and stare direct at the sun for extended periods still feels a little like jumping out of a plane without a parachute. However, dedicated hydrogen alpha telescopes can bring out levels of visual detail on the Sun's surface that are far superior to the traditional add-on white light filter, and in a manner that I personally found very compelling. To those of you that are unaware of hydrogen alpha solar observing, this Presidents Corner is particularly addressed.

The introduction of hydrogen alpha solar filters and telescopes into the amateur market is invariably associated with the name of the late David Lunt (1942 - 2005) who previously developed professional astronomical instrumentation including the telescopic mirrors used in NASA's Orbiting Solar Observatory.

His new company Coronado entered the amateur market in the late 1990's with a series of hydrogen alpha solar filters, enabling observers with small refractors to view the Sun's chromosphere, the

thin active layer above the photosphere or visible "surface". Though the technology was not in itself new, Lunt's breakthrough was to develop portable affordable filters that were completely stable in the field and did not require electrical power. Though initially quite expensive due to precise manufacturing requirements, Coronado established a complete line of increasingly affordable solar telescopes and filters that remain in production today, including the small PST (Personal Solar Telescope) often seen at star parties. In 2004, Coronado was sold to Meade, and though David Lunt himself passed away in 2005, his son Andy Lunt in 2008 established a new company called Lunt Solar Systems to further develop solar



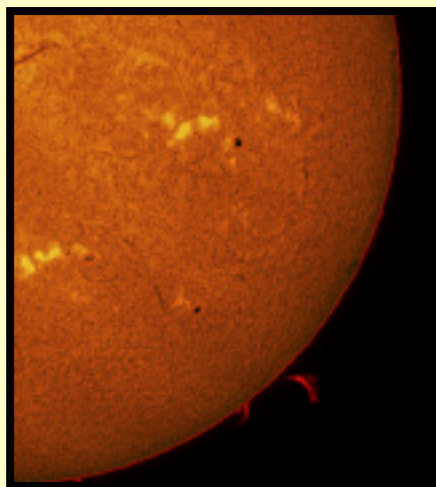
Examples of front energy rejection filters. (Coronado)

viewing systems for amateurs. As a result there are now two primary manufacturers of these specialized telescopes in the USA, both originating in the legacy of David Lunt. In fact some solar observers combine solar filters from one company with solar telescopes from the other, resulting in a "Luntenado".

Observing the Sun in Hydrogen Alpha *(Continued from the previous page)*

In a generic hydrogen alpha solar telescope, the incoming sunlight is filtered through 3 stages. First an energy rejection filter (ERF) blocks the UV and IR and only allows the crimson part of the spectrum to pass further into the telescope. Next, this filtered light encounters a specialized filter called an etalon that lies at the heart of the instrument. An etalon utilizes interference methods specifically optimized to only allow the extremely narrow hydrogen alpha wavelength to pass through (the “bandpass”) and is fairly simple in principle consisting of 2 precisely flat parallel optical surfaces coated with a highly reflective dielectric layer separated by a small air gap. The transmitted sun-light reflects back and forth in the gap between the reflective surfaces, the width being an integer multiple of half the wavelength so that only light that meets the correct angle of incidence with the filter surface can pass through. The advantage of an etalon filter is that it can also be tuned to vary the wavelength of light, revealing different levels of detail on the solar surface. In the case of Coronado solar telescopes, this is done by tilting one etalon filter surface in relation to the other, slightly altering the wavelength of light passed. More recently, Lunt Solar Systems has introduced a newer “pressure tuned” approach in which the gap between the two filters is enclosed in a sealed unit where changes in the internal air pressure are used to adjust the refractive properties of the trans-

mitted light. The final component in the light path before it reaches



A hydrogen alpha view of the Sun (Alan Friedman) It really does look like this through an eye piece.

the eye is a blocking or trim filter built into the diagonal that removes all the remaining extraneous wavelengths, excepting the very narrow hydrogen alpha bandpass revealing the Sun’s details such as solar prominences on the Sun’s limb, dark filaments crossing the disk, flares around sunspots, and the granular “surface” of the Sun itself.

It should be apparent from the above description that solar telescopes represent a distinctive telescopic technology in its own right, and that though they are essentially a type of refractors, their internals are more complex. The size of the filters are a critical component in the final cost of the telescope that become significantly more expensive the larger the aperture.

The Coronado 90mm Solar Max that I was loaned came in a solid black case with custom eye-

pieces. Despite its medium size, it is a hefty and weighty instrument that needed to be securely attached to my backyard equatorial mount. Though most eyepieces will work with solar telescopes, minimal glass designs such as orthoscopes and plossls are often preferred over the multiple-glass ultra wide angle eyepieces used in night sky observing, because of



The Coronado 90mm Solar Max 2 resting on my AP1200 mount.

their higher risk of internal reflection. In the picture, the energy rejection filter is right at the front, and the “hinge” and air gap where the two optical surfaces of the etalon can be tilted relative to each other is just visible on the front cell and can be adjusted with a small wheel. The 1.25” gold blocking or trim filter diagonal can be seen at the rear under my camera.

To aim a solar telescope accurately is harder than it first appears as it is just too bright to stare anywhere near the Sun for precise visual aiming. The GOTO on my mount reluctantly pointed the solar telescope in the right direction (after several “are you really, really, sure” checks) but the telescope came with a handy small solar finder-scope that proj-

Observing the Sun in Hydrogen Alpha (Continued from the previous page)

ects a small pinhole image of the sun onto a frosted glass plate in a small tube when it is properly aligned. Then you merely put in an eye-piece, focus as you would a traditional refractor and look... and there it is, the Sun in all its glorious granular detail with sun spots, prominences, and flares all visible. Better, my eyeballs were not smoking! Even better still, I become aware over time that these phenomena looked slightly different in repeated viewing and were actually moving. That in itself was a bit of a culture shock for this night time observer when nothing in the sky ever changes on any human timescale. Also, by tweaking the etalon I could bring out different layers of surface detail that is just not visible through standard white light filters, and there was a sudden moment of realization that the

Another subjective observation is that when observing by night you usually have to wrap up to avoid getting too cold, but with solar observing you are either comfortable or too hot! Oh well, astronomy is all about extremes.

to really enjoy an immersive view. Of course that does not make one any cooler. Solar observing comes with its own set of challenges

.My next experiment was to attempt my first photograph of the Sun's surface. To do so I just plugged in a Canon 40D DSLR camera into the diagonal and did my best to eyeball the focus in live view screen on the back of the camera. This was quite hard to do, as the Sun has few hard edges on



Not a Monk - my Son Nick all wrapped in a hood up to increase visual contrast

Because of the human eyes high dynamic range, it is possible to see both solar prominences, filaments, and granular surface detail all at once through the eyepiece. This aspect does not always come across in photography of the Sun where you usually see one or the other, unless multiple images have been combined. Another aspect of solar observing that soon became

apparent is that daylight is.. well rather bright, and that all that extraneous daylight distracted from the sharp quality and contrast of the view. I soon found that I could greatly increase contrast by draping a dark cloth or astronomers hood over my head

which to actually focus. In the end I got it reasonably close and racked the focus shot by shot to ensure at least one image was in good focus. Not very sophisticated and there are better methods, but it worked well enough to capture significant surface detail on the Sun first time out of the gate. The images produced by dedicated solar imagers using video cameras and frame stacking can be much more impressive as can be in Alan Friedman's partial image of the Sun's limb above. However I did achieve a reasonable image, (below) though I should say that personally I found that the visual image through an eyepiece was more satisfying.

It is possible to view the Sun through other wavelengths than hydrogen alpha and standard



My son Nick enjoys the view.

heat I was feeling directly on my skin, left the object I was directly viewing just eight short minutes before. That delivered a sense of immediate connection that is quite different to looking at more remote interstellar objects.

Observing the Sun in Hydrogen Alpha *(Continued from the previous page)*

white light. Calcium K (Ca-K) is one alternative lying right at the edge of the visible spectrum at the UV end, that reveals a quite different view of the solar surface. However this wavelength is actually fairly difficult for some people to see, and is often more suitable for imaging only.

The Coronado 90mm Solar Max will soon have to go back to its owner, but the experience of solar observing has been personally rewarding enough that I have decided to acquire my own solar telescope from Lunt Solar Systems. It should arrive in time to witness the Venus transit as

well as the greater activity on the Sun's surface as the solar maximum approaches. 2012 is a good year for the Sun.

Solar observing is a different kind of astronomy, yet one that connects one in a very profound way, not only with our own star, but by association with all the distant stars that we observe at night.

Chris Ford

(With thanks to Pierre Schwob for the loan of his Coronado Solar 90mm Solar Max)



My first ever hydrogen alpha picture of the Sun with a Canon 40D DSLR.

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Stonehenge and the Origins of Civilization

by Nathaniel Bates

The traditional story of the birth of civilization is heavily influenced by the dominant prejudices of historians.

Until recently, historians held to a view of civilization dictated by nineteenth century ideologies of progress, coupled with the notion that history is driven by material forces. According to this view, civilization arose because agriculture was discovered. Then, civilization advanced because of new scientific discoveries.

Primitive humanity could not have known of such things as astronomy or mathematics because in their view such discoveries were known only

to more advanced cultures. The entire western world adopted the view of primitive humanity as being on a lower stage of development than the modern world. However, this was not the view of the ancient world. The classical world of the Greeks believed that their forebears had knowledge and wisdom that was lost.

Earlier humanity was vested with knowledge that was lost, a view that modern historians considered to be romantic delusions. It was not until the 1960's, starting with groundbreaking work by Gerald Hawkins on Stonehenge as a possible ancient Observatory,

that historians were forced by one lone astronomer to reconsider their views at least in part. Our view of ancient humanity has never been fully the same since.

Thanks in part to Gerald Hawkins, our current notions of so-called "primitive" cultures is at least somewhat different than what it was in the late nineteenth century. As Astronomer by training, Hawkins was willing to consider the possibility that primitive humanity had knowledge of



Stonehenge

Astronomy. He was willing to consider the possibility that Stonehenge was a type of Observatory, one used by Priests to measure the seasons and allow for proper planting times. He set out to prove that astronomical events could be proven. Perhaps even a degree of fear could have been used over the population given that the Priests held a knowledge that would not have been widely available to the populace. An eclipse that "usurped the sun" at the wrong time of year means trouble for the nation! The king and people had better heark-

en to our word! At least that is speculation. In actuality, there is a lack of records of Britain in the age when Stonehenge was built so we do not know what motives the Priests might have had. However, even in lieu of the lack of records it appears from the layout of Stonehenge itself that the Priests might have had a great deal of astronomical knowledge. Hawkins was willing to take on the task of finding out just how much.

According to Hawkins, Stonehenge was a kind of cosmic computer aligned with the stars.

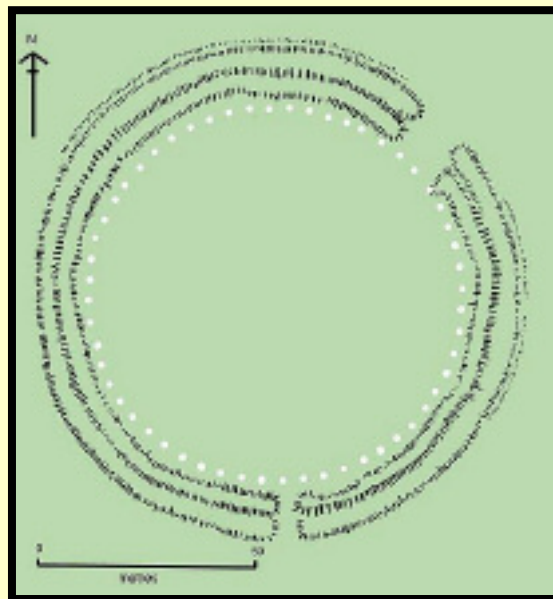
He believed that the stones were laid out as a calendar that would be used to predict the intersections of solar and lunar cycles, eclipses could be predicted, as could the relative motion of the Moon with reference to the Sun. Those views were resisted by historians and are still controversial. One important criticism made by historians holds that we should not project our own notions of the Calendar and the passage of time back on to the past. Presumably the ancient Britons would not have had our concept of Astronomy or time. This may very well be true. However, we must point out that if the evidence from the layout of Stonehenge itself suggests knowledge of celestial mathematics, then we must consider the evidence and go where that evidence leads. Too many "coincidences" suggest a pattern. Furthermore, we would then have to be ready to re-evaluate comfort-

Stonehenge and the Origins of Civilization *(Continued from the previous page)*

able assumptions about history and our notions of progress.

Hawkins' argument was laid out in *Stonehenge Decoded*. This 1960's classic asked us to consider the fact that the solar and lunar cycles allied every 18.61 years. The book then points out that the very first design of Stonehenge was an array of 56 monoliths in a rough circle. 56 is very close to three times 18.61. The fit is not exact, but it is close enough to consider the possibility that there is some kind of alignment every 56 years with a margin of error that Priests could account for. At least the alignment would be close enough to be roughly calculable given other astronomical knowledge and a good knowledge of the calendar. The people would be impressed, and as those of you who do star parties know well that an impressed public is often the name of the game.

The beginning phase of Stonehenge is called "Stonehenge I" by historians. Stonehenge was built in the third millennia before the Common Era. Some estimate place the beginnings of Stonehenge even earlier than the Third Millennium BCE. The earliest Stonehenge was a roughly circular array of "Aubrey stones" that aligned with the "heel stone" in a fit such that, if one were standing in the middle of the circle at that time, midsummer sunrise would rise behind the heel stone. As Stonehenge evolved, more astronomical alignments were built in to Stonehenge, including the mid-winter sunrise and possibly various eclipse alignments. Even the



Stonehenge

year and date of a possible eclipse alignment could be predicted by the Priests given the exact alignment of the sun and moon. Error was possible when predicting eclipses, but Hawkins conjectures that it was easier to be wrong about an eclipse date than to fail to predict one. A false prediction could be explained as the sun or moon being appeased. Failure to predict would create mass panic about a possible cosmic calamity to come if the sun or moon were not appeased. Astronomy was serious business, a matter of national security. It was not even just a matter of when to plant. The very balance of the cosmos hung in the balance. One would hope for a similar level of enthusiasm among our Club's star parties today!

What is most interesting about Hawkins work is that his calculations were done on a computer.

He credits the computer more

than himself (characteristic modesty makes his writing that much more enjoyable). The fact that he made grand claims based more on the calculations of a computer than on simple evidence was controversial, and he did not shy from controversy. Attacks from other scholars were based on a number of evidentiary points, among them the fact that Stonehenge does not align perfectly. Oddly, Hawkins himself acknowledges this. He even points out

the failure of the 56 "Aubrey stones" to form a perfect circle. His wording is somewhat vague on this point, but he seems to suggest that perhaps the failure to form a perfect circle was deliberate. Personally, I speculate that perhaps the ancient Priests did not want Stonehenge to be fully accurate so as to conceal the nature of Stonehenge as a cosmic computer to an intelligent lay person who might desire to use it themselves. The other possibility is acknowledged by historians themselves (who tend to be more skeptical of Hawkins than Astronomers). They acknowledge that wooden structures were erected that we do not know too much about during the later phases of Stonehenge's development. Perhaps those wooden structures would have been used, somehow, to make the fit with the sun and moon exact. It may even be that some of the wooden structures took in to account planetary motions. If so, then much of the

Stonehenge and the Origins of Civilization *(Continued from the previous page)*

brilliance of Stonehenge during the early period was lost to history. Eventually, Stonehenge itself was lost to history as it appears that the sophisticated scientific knowledge of ancient Celtic cultures eclipsed during the various Roman conquests and certainly by the Dark Ages. Many of the mysteries of Stonehenge may well be lost to us.

One famous criticism of Hawkins' calculations is rather interesting when one thinks about it. One criticism holds that, if Hawkins' calculations are true, Passover could be calculated using Stonehenge also. Passover would have been unknown to the ancient Druids, thus implying that what Hawkins stumbled upon is more coincidence than anything that the ancient Celts would have created as part of their culture. Indeed, Hawkins acknowledges this point himself. Readers should understand that the Hebrew Calendar relies on the alignment of the sun and moon. It resets every 19 years, roughly in accord with the 18.61 year alignment of the sun and moon. Thus, the ability to predict Passover using Stonehenge would not be so surprising. The Hillel Calendar is both solar and lunar, much as Stonehenge appears to be. The fact that Stonehenge could be used to predict Passover on a given year might actually lend credence to Hawkins' argument.

The new evidence holds that Stonehenge might have been built around sonic wave patterns. If this new theory is born out, then it might well be that Stonehenge

impressed a Neolithic audience with both an astronomical show and also the use of various sounds to produce resonance effects. Priests who could master both of these would have a hold on the population, one earned in the mind of the people by their ability to give the common people a sense of communion with the Cosmos itself. Indeed, a civilization that could form a structure like Stonehenge around both sonic resonance and astronomy deserves the respect of moderns as well as ancients. Add to that possibility that idea that medicine might have been practiced there and we can clearly see that many comfortable assumptions need to be rethought.

Astronomers tend to be favorable to Hawkins, while historians still often resist his arguments.

It comes to a split in philosophy between the two camps. Many historians still want to cling to the idea of history as an unfolding of progress. The idea that knowledge would be lost in the midst of prehistory is deeply unsettling to those who want to see history as a simple narrative of continual advancement. Still others of a more contemporary bent will argue that one should not take the scientific or philosophical tendencies of our time and project them backwards on



Gobekli Tepe

to prehistory. The idea that we can assume that ancient Celtic Priests were technocrats who wielded power through the appearance of occult knowledge might well be taking the cynicism of our time, forged as it is by Watergate and various subsequent



Gobekli Tepe reptile

political scandals, and projecting it in to the mists of pre-Roman England.

Hawkins went on to write other accounts of other archaeological mysteries. He speculates that advanced knowledge of Astronomy was global, in far flung cultures across the globe. For him, the Neolithic period was a time of

Stonehenge and the Origins of Civilization *(Continued from the previous page)*

knowledge and not ignorance. My question is, "What about the Paleolithic Age?" Was that a time of knowledge as well? One clue is found in Turkey, right at the bridge between the Paleolithic and the Neolithic. It is called Gobekli Tepe and it was established by hunter-gatherers! It was not built by an agricultural civilization, but by a civilization that presumably did not know planting. Gobekli Tepe has all manner of animal depictions, much as cave art would have.

The usual narrative about the origin of agriculture and the Neolithic holds that agriculture was somehow "discovered" and people settled down. Yet, anthropologists who have studied

that hunter-gatherers lived better than the serfs and slaves of early hierarchical agricultural civilizations. Thus, we can speculate on one of two possibilities. Conquests may have forced hunters to give up their ways. This was certainly true of many Native Americans in our country. The other possibility might have been the effective use of astronomical knowledge by Priests, coupled with the use of religion, to convince populations to settle down and utilize agriculture. Those populations would then support the Priests out of a mixture of fear and admiration. Gobekli Tepe seems to point to the idea that religious structures may have been settling points for hunter-gatherers who soon stayed in one place and began to plant instead of hunting. Personally, I have always viewed as suspicious the idea that hunter-gatherers could not have known of the idea that seeds would germinate in to plants. The theory that agriculture was "discovered" makes less sense to me than the idea that agriculture became widespread when the culture of the globe changed.

What if an astronomical use for Gobekli Tepe is discovered at some point?

If such a use is discovered, then it might add to the possibility that this astronomical knowledge translated directly in to a cal-



Gobekli Tepe circles

endar that would then be used to convince hunter-gatherers to become farmers. It is a possible long shot, but not beyond the pale. If provable, then we can assume that scientific knowledge on the part of Paleolithic Shamans might have given birth to agriculture rather than the other way around. It would completely revolutionize the dominant narrative about history, and about the birth of our form of civilization.

We would have to re-evaluate the idea that much of civilization "advanced" due to material conditions. Instead, material conditions themselves were partially formed by the effective use of ideas. As with Hawkins when he set out, we do not yet have the evidence, but perhaps we can at least begin a process of consideration, investigation, and wonder.

Nathaniel Bates



Gobekli column

hunter-gatherers doubt that people gave up hunting willingly. Most hunter-gatherers seem to have clung to their ways, given

Spaceship Earth (Continued from page 1)

ed to decline over a period of ten years. After this, it is unlikely that humans will survive without adequate protection from the sun. Plant and animal life will be severely affected as reproduction rates decline and crops are lost. Seed germination slows considerably.

The world's economy rapidly changes. Things like Hollywood, BMW's, and flat screen TVs are suddenly unimportant.

People, collectively, try to devise ways to save their lives and the lives of their children. Nationalism increases and immigration ceases as countries try to minimise the size of the population they must protect.



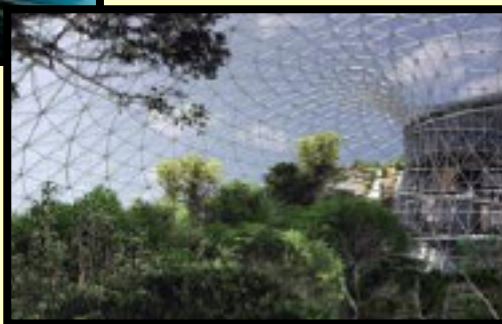
Organizations quickly form with various goals. One group decides to build an "arc", a giant dome to cover their city and farmland. Others decide to dig caverns with glass ceilings to filter sunlight over small crops. However, cloud cover is expected to increase substantially as the climate rapidly changes, limiting the effectiveness of these greenhouses. Relocation to Mars is considered, but due to the difficulty of reaching the sur-

face, it's ruled out. Another organization will attempt to colonize the moon. But the moon, which has a six-hundred-fifty-six hour day, is not conducive to crop growth or thermal equilibrium.

One group takes a different approach. Spaceship Earth. A giant rotating sphere in space with an asteroid core, (possibly asteroid Astraea or asteroid Metis). Spaceship earth will become new home for hundreds of thousands of people. It is grand idea and an unimaginably complex engineering endeavor, which, if successful will

enable humanity to live in relative comfort for the duration of the long absence from planet earth.

Motivated by a strong desire to evacuate the planet, society reorganizes itself and



additional means to access space are constructed. The first design is an orbital cannon. With this giant cannon, supplies are shot into space inside "bullets" that are then collected by a space-station in Low-Earth-Orbit.

Then, a "Space-Elevator" is constructed. A Space-Elevator is a tether hanging from a space station located in geosynchronous orbit. With development of the high tensile strength cable com-



pleted in late 2012, all that was needed was to get secure counterweight in space. This is easily accomplished using the space-cannon. The advantage of the Space-Elevator is that objects launched from the outpost atop the elevator can easily achieve inter-planetary trajectory.

A site is chosen for construction of Spaceship Earth. It's an asteroid one-hundred million miles past the orbit of Mars in the Asteroid field. The Asteroid is 40 miles in diameter and has an iron core, providing a week, but noticeable, gravitational field.

A mining expedition sets out to the asteroid field. Nuclear-Electric powered ion engines are used to accelerate and decelerate the crafts. At certain times of the year, the gravity of the asteroids Ceres and Vesta are also used to slow down the spacecraft.

Spaceship Earth (Continued from the previous page)

The team of "asteroid-miners" begin mining ore and manufacturing steel and glass from the asteroids. Nuclear-furnaces provide the energy required to refine the newly excavated ore. The asteroids on the near-side of the asteroid field are metallic, mainly iron, nickel and titanium. The asteroids closer to Jupiter are made mostly of carbon elements, providing all the necessary ingredients to pro-



duce the finest steel and glass. A store of these commodities is assembled around the asteroid soon to become Spaceship earth.

Back on planet earth, people are selected to become Spaceship Earth's first residents. farmers, doctors, engineers, teachers and scientists are high on the priority list, along with their families. Spaceflight is now considered as safe as airline travel.

More and more construction crews head to the asteroid belt on larger and larger spacecraft. A second, then a third, Space-Elevator is constructed. The efficiency of ion engines has been vastly improved and nuclear fusion is widely used to power these missions, (although a solar-sail was

used once or twice).

Special missions are deployed to outfit the outpost with a sufficient supply of water. One of Jupiter's moons becomes the primary source of H₂O. This water can also be used to create oxygen on Spaceship Earth and the water's hydrogen atoms can be used for fuel. Later, a passing comet is also mined for it's water.

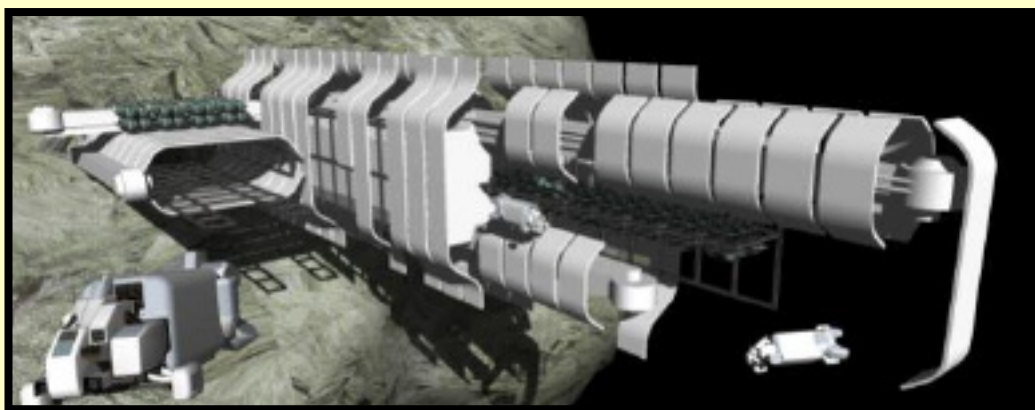
Engineering teams begin to construct the truss system that will support the living surface or "ground" of Spaceship Earth. The surface of the comet is a few thousand square miles (Radius = 20 miles, therefore $4\pi R^2 = 5026$ miles) even though the asteroid is only 40 miles wide. There is a lot of work to do.

Giant hexagons and triangles of steel "floor" components are constructed. It will take over one-hundred thousand of these giant puzzle pieces to finish the surface of Spaceship Earth.



In addition to surface structure, hexagons and triangles pieces of "sky" are designed and built. These giant plates of glass and titanium will become the roof of spaceship earth. This glass-titanium structure is all the holds in the atmosphere. Two layers of "sky" must be created to insure the integrity of the roof structure. A "service" space will separate with two layers for repairing the glass plates and a layer of water must also be used to block harmful cosmic rays.

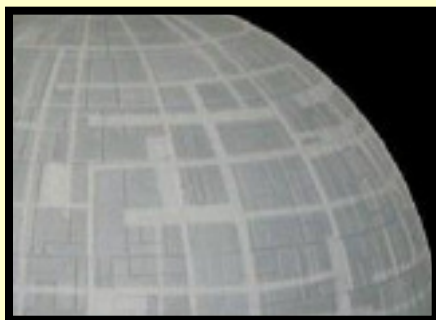
Giant Space-Cranes are used to move the hexagonal framing into place. It takes only two years to construct the framing. This is ahead of schedule; self replicating machines have improved productivity by a factor of 1000. The people are also highly motivated, eager to move into their new homes. year later, the "floor" is



Spaceship Earth (Continued from the previous page)

completed and Spaceship Earth now looks like a small moon (not unlike a certain space station in the movie Star Wars).

Soil is created from crushed asteroid rocks, it will be fertilized with minerals from earth as soon as the atmosphere is established.



The supports for the glass roof are constructed made to look like the pillars or ancient Rome. The tall columns don't need to be very strong because the gravity is so weak that the sphere will hold itself in place.



The glass roof comes together and atmosphere is pumped into Spaceship earth. Additional stores of nitrogen and CO2 are borrowed from the atmospheres of Mars, Earth and Venus. These gasses were gathered by "collector" spacecraft in orbit of these planets.



At this point, there are thousands of workers on the on new colony and hundreds of thousands are on their way.

Powerful ion-engines slowly adjust the rotation of Spaceship Earth. The day/night cycle of the new planet has begun.

Farmers plant their first crops on the new world. Sky scrapers are constructed, reaching to the top (and sometimes beyond) the glass dome.

Parks schools and shops are designed and built. The people have their first election. A river flows around the planet and a warm breeze blows gently due to Coriolis force. A zoo is constructed as well as a small sheep farm for textiles. People a become mainly vegetarian because live-stock are declared "too inefficient" to be used as a source of food.

Oil is manufactured from algae and becomes the primary source for all plastic, polyester and petroleum. Power is mainly

nuclear or fusion, but unlike on earth, it is easy to dispose of nuclear waste in space.

Spaceship Earth is beautiful! Birds fly over the farmland and a river flows into a lake where a beach has been designed. Sunlight streams in through the glass roof onto the swimmers below. Clouds and mist form over the land as water is rained down over the lands.



New sports have been invented. With only a thousandth of earth's gravity children in winged suits are able to glide through the air. There is no point in riding a bicycle, a slight bump with throw you a hundred feet into the air. Mono-rail and light aircraft are the primary ways of commuting.

With the success of Spaceship Earth, another outpost is planned, providing thousands of jobs for the inhabitants of Spaceship Earth for years to come. Soon, Spaceship Earth 2 will become a new home many people voyaging away from a hibernating earth.

John A Read

Mount Diablo Astronomical Society Event Calendar–March 2012

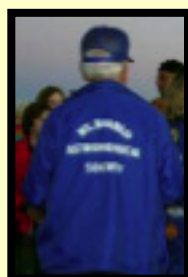
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27	28	29	DVMS Stargazing (CANCELLED) (Private) 1	Timber Point Stargazing (Private) 2	3
						Sunset: 6:05 PM
4	5	6	7	8	9	Observatory Maintenance (Private) 10
						Sunset: 6:12 PM
11	Cub Scout Astronomy (Private) Board Meeting (Private) 12	MDAS Imaging SIG (Private) 13	14	15	16	Society Observing (Private) 17
						Sunset: 7:18 PM
18	19	20	21	Telecom: Dr. Avanti (Private) 22	23	7:00 PM Public Astronomy 24
						Sunset: 7:25 PM
25	Riverside Stargazing (Private) 26	7:15 PM GenMig: Planet Hunting 27	Cambridge Stargazing (Private) 28	Buena Vista Stargazing (Private) 29	30	31
						Sunset: 7:31 PM

Time to Order Your MDAS Jacket!

Time to place your order for the new royal blue, embroidered and personalized MDAS jacket. We are planning to place the order by February 6th, so reserve yours now:

http://www.mdas.net/mdas_store.html#MDAS_Jacket

If we place our order in early February, the jackets will be ready by our February 28th meeting. You may also reserve your personalized jacket by sending an email to memberinfo@mdas.net or call Marni Berendsen at 925-930-7431.



Be sure to tell us the size you want (M, L, XL, XXL) and the first name you want embroidered on the jacket.

You can bring a check for \$55 made payable M.D.A.S. to the January meeting or send the check to this address:

**Mount Diablo Astronomical Society
P.O. Box 4889
Walnut Creek, CA 94596**

Board Members & Address

President

Chris Ford - cford81@comcast.net

Vice President

Rick Linden - Rick.C.Linden@gmail.com

Membership Coordinator, Mtg Room

Marni Berendsen - berendsen@aol.com

Meeting Program Chair

Dick Flasck - rflasck@aol.com

Outreach Coordinator, AANC Rep

Jim Head - jamesnhead@comcast.net

Publicity Board Member

Steve Jacobs - llasjacobs@astound.net

Observing Committee Chair, Board Member

Richard Ozer - rozer@pacbell.net

Whats Up Coordinator, Board Member

Kent Richardson - kayarind@sbcglobal.net

Treasurer

Will Roberge - wil@donabue.com

Newsletter Editor

Vianney - veloroute@hotmail.com

Webmaster

Glenn Spiegelman - gspie@comcast.net

Secretary and Refreshments

Moon Trask - metallicamoon@sbcglobal.net

New Member Steward

Nick Tsakoyias - claytonjandl@aol.com

Mailing address:

MDAS

P.O. Box 4889

Walnut Creek, CA 94596-

General Meetings:

Fourth Tuesday every month,

except on the third Tuesday

Refreshments and conversations

Meetings begin at 7:15pm.

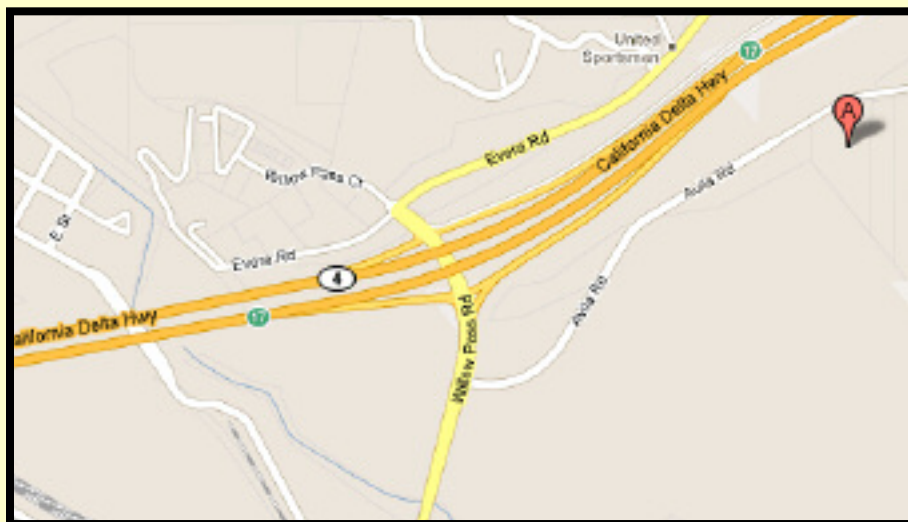
Where:

Concord Police Association

5060 Avila Road, top of the

Take Avila Road from Willow

Directions to facility:



Your Help Would Be Greatly Appreciated

Our association needs a few members to come at 6:30 p.m. before our monthly meeting which starts at 7:15 p.m. to help in setting up the chairs and other elements needed to conduct the general meeting.

Similarly at the end of each meeting the chairs and tables have to be removed, the room has to be cleaned and the garbage emptied.

Thank you for your help.

